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POSTAGE STAMPS FOR METEOROLOGICAL EDUCATION INCLUDING A BRIEF HISTORY OF WEATHER SATELLITES

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1. INTRODUCTION

When most people hear the term 'stamp collecting', they think about someone saving all the stamps issued by a particular country. Such country-oriented collections are common. However, another popular hobby is collecting a particular theme or topic on postage stamps. This is called 'topical stamp collecting', where the idea is to collect stamps with a central theme in mind. Common collecting themes are space stamps, bird stamps, butterfly stamps, and Scout stamps. Many other more specific topics are also possible. The author has published two previous articles on topical stamp collecting (Hillger and Sokol, 1988; Hillger, 1991).

Topical stamp collecting has the added advantage that one has to know the chosen topic very well. You must decide which postage stamps belong in the topical collection, and even more importantly, which stamps do not. The idea is to learn as much about the topic as possible while making those decisions. Also, many postage stamps contain errors in the information printed on the stamps that may puzzle the topical collector, but these same errors can also make the topical collection more interesting. The ease of finding errors comes with increasing depth of understanding as one becomes more familiar with the chosen topic.

The author is interested in the topic of weather stamps. A list of weather-related stamps has been compiled which includes over 1500 stamps from about 150 countries! Collecting all these stamps would be quite a task. The stamps were printed over the last 30 plus years by many countries, and some of the stamps are rare and expensive to obtain. Many of the early weather stamps are nicely covered in an article by O'Neill, et al (1970).

There are many sub-topics of weather stamps that can be collected. Some of these sub-topics include World Meteorological Day [March 23 every year since 1961 (*WMO Bulletin*, 1994)] and the World Meteorological Organization (WMO) and its centenary in 1973 (*WMO Bulletin*, 1974). The author has chosen to collect stamps that are related to the topic of weather satellites. The number of weather-related satellites launched by the U.S. alone is in the hundreds, with many more weather-related satellites having been launched by the former Soviet Union. In addition, many other countries are now contributing their own weather satellites, especially the Europeans and the Japanese.

Weather satellites have been collecting information about the earth and atmosphere for over 30 years. The variety of information they have collected is covered in Kidder and Vonder Haar (1995), but the depth of information fills many books. Measurements are taken in many regions of the electromagnetic spectrum by a variety of satellite instruments. Infrared and microwave measurements now complement the visible images collected by the world's first meteorological satellite (TIROS-1, discussed below) in 1960 (Rao, et al, 1990).

2. METEOROLOGICAL EDUCATION

To cover the broad spectrum of weather-related postage stamps would be impossible

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in such a short article. The range of information is enormous, but by choosing a sub-topic, the information can be handled quite nicely. Many articles have been published on sub-topics of weather stamps. Many of these articles were written to educate the reader about the topic being discussed (Kessler, 1995; Mao, 1992; Schlich and Schlich, 1990; Schmid, 1993). Postage stamps are a unique and entertaining way to present almost any topic, since almost every topic has been covered on stamps.

3. WEATHER SATELLITE HISTORY

The topic of weather satellites has been chosen for this article. Even with this narrowing of the topic, the number of postage stamps related to weather satellites is still over 300. Not all of these stamps, nor all of the weather satellites will be mentioned. The stamps shown will concentrate on the U.S. space program, but a few notable weather satellites from other countries will also be included. For most satellite series, only one stamp is featured, even though many other stamps exist. However, in some cases, only one stamp may exist for a particular satellite or series of satellites.

3.1 The First Weather Satellites

A few years after the first artificial earth satellite, Sputnik-1, was launched by the Soviet Union in 1957, the first earth photo was taken by the U.S. Explorer-6 satellite in 1959 as part of its mission to gather radiation data (TRW, 1991). However, the world's first dedicated meteorological satellite, TIROS-1, was launched by the U.S. in 1960. In total, ten TIROS (Television and Infrared Observation Satellites) were successfully launched from 1960 through 1965. The TIROS research and development series was immediately followed by nine ESSA (Environmental Science Services Administration) operational satellites launched between 1966 and 1969. There was a commitment to acquire worldwide observational data from satellites on a daily basis. These satellites were also called the TOS (TIROS Operational System) satellites.

TIROS / ESSA satellites can be found on over 50 postage stamps from around the world, including the first known stamp to feature a weather satellite issued by Mauritania in 1963, shown in Figure 1.

In 1970 the second generation of U.S. weather satellites began with the launch of the first of the ITOS (Improved TIROS Operational System) satellites. The ITOS satellites were three-axis stabilized, unlike TIROS / ESSA satellites which spun on one axis for stabilization. One of the ITOS satellites is shown in Figure 2, on a stamp issued by Barbados in 1979. Only two other stamps are known to show ITOS satellites. A total of six ITOS satellites were successfully launched, including the first five satellites designated NOAA (for the National Oceanographic and Atmospheric Administration). Two satellites, ITOS-B and ITOS-E, failed to orbit due to launch problems. (Letters are used to designate satellites prior to launch, and numbers are assigned only to satellites that successfully achieve orbit.)

3.2 Other Early U.S. Weather Satellites

The Nimbus satellite series was developed by NASA in the early 1960s. It was initially intended as a replacement for the TIROS series, but became a basic spacecraft type for testing new instruments. A total of eight Nimbus satellites were built, seven were orbited and one was lost due to a launch failure. Like TIROS satellites, Nimbus satellites were featured on numerous postage stamps. Figure 3 shows a stamp from Sharjah issued in 1964 representing this series of satellites. Nimbus satellites are three-axis stabilized like ITOS satellites, and appear similar to an ocean buoy with wings.

NASA also developed the ATS (Application Technology Satellite) program to demonstrate communications technology from geostationary orbit (41,000 km altitude). ATS satellites had excess capacity which was taken by meteorological sensors used for experimental observations of the earth from a much higher orbit, one which maintained a constant view of the earth, unlike previous satellite series that orbited at about 1000 km altitude. Geostationary orbit allows real-time monitoring of the evolution of weather systems. Figure 4 shows a stamp issued by Grenada in 1973 featuring ATS-3, the third in the series of ATS satellites. Of the ATS

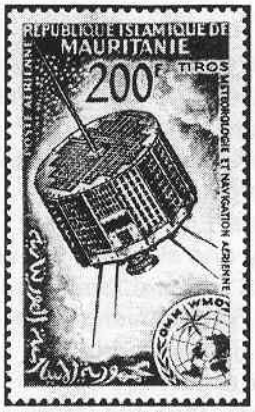

Figure 1. This stamp from Mauritania, issued in 1963 [Scott no.C25], is the first known postage stamp to feature a meteorological satellite, one of the TIROS series of satellites launched by the U.S.

Figure 2. This stamp from Barbados, issued in 1979 [Scott no.516], is one of only three known postage stamps to feature the Improved TIROS Operational System (ITOS) series of satellites launched by the U.S. The satellite is incorrectly identified on the stamp as an Intelsat (communications) satellite.

Figure 3. This stamp from Sharjah and Dependencies, issued in 1964 [Scott no.43], is the first and one of the better representations of the Nimbus series of experimental meteorological satellites, which has been pictured on many postage stamps from around the world.

Figure 4. This stamp from Grenada, issued in 1973 [Scott no.494], showing ATS-3, is one of many postage stamps showing this first U.S. series of geostationary satellites with both communications and meteorological capabilities.

Figure 5. This stamp from Wallis and Futuna Islands, issued in 1979 [Scott no.C90], is one of the best representations of the French Eole weather satellite on postage stamp.

Figure 6. This stamp from Cuba, issued in 1983 [Scott no.2587], is one of many postage stamps, mostly from Soviet-block countries, featuring the extensive series of Meteor weather satellites.

series, only ATS-1, -3 and -6 carried meteorological sensors. ATS-1 and -3 were spin-stabilized like the TIROS series; ATS-6 was three-axis stabilized and is not known to have appeared on a postage stamp.

3.3 Early International Weather Satellites

One international satellite which has been featured on stamps is the Eole satellite launched in 1971. Eole was a cooperative U.S.-French experimental program to collect data from free floating balloons. Figure 5 shows a very nice representation of the Eole satellite on a stamp issued in 1979 by Wallis and Futuna Islands.

Other countries have launched limited numbers of weather satellites, some of which will be covered below, but no country has launched as many satellites as the former Soviet Union. Their first weather satellites were part of the Kosmos (or Cosmos) general purpose satellite series which now number well over 2000. In 1969 certain satellites were named Meteor marking the beginning of the operational status of their weather satellite system. Meteor satellites are featured on a number of postage stamps, most of which come from Soviet block countries. Figure 6 shows a Meteor-1 series satellite on a stamp issued by Cuba in 1983. The Meteor-2 series began in 1975 and the Meteor-3 series began in 1985, all of which appear relatively similar, with only minor differences in details (Soviet, 1990). Over 50 Meteor satellites have been launched to date.

3.4 Current U.S. Satellite Series

In 1978 the first of the third generation U.S. operational polar-orbiting satellites was launched, TIROS-N, which was never given a number designation. However, succeeding spacecraft were designated NOAA-6 and on. Advanced versions of NOAA satellites, called ATN (Advanced TIROS-N) have since been launched starting with NOAA-8 in 1983.

Figure 7 shows one of the NOAA series of satellites on a postage stamp issued by Taiwan in 1981. Only four stamps are known to show NOAA polar-orbiting spacecraft which are still the current operational polar-orbiting system.

Geostationary meteorological satellites are now also part of the operational satellite system. The first two geostationary weather satellites after the ATS series were designated SMS (Synchronous Meteorological Satellite), followed by three GOES (Geostationary Operational Environmental Satellite) launches. Only one stamp is known to show the SMS / GOES series of spacecraft which spin on one axis. The souvenir sheet in Figure 8 contains one stamp issued by St. Lucia in 1983. Souvenir sheets are sold mainly to stamp collectors, thus the large surrounding area which gives a second view of the SMS / GOES series satellite.

Follow-on satellites were also called GOES. The first of these, GOES-4, was launched in 1980 with a modified design, not known to be pictured on a postage stamp. Five of these GOES spacecraft were built, but only four were successfully launched. One satellite was destroyed due to a launch failure, leaving GOES-7 the last in the series.

In 1994 the first of the GOES-Next (I through M) series of satellites was launched. Unlike previous GOES, the spacecraft is three-axis stabilized. Originally to be launched in the early 1990s, the first, GOES-8, was finally launched in 1994, however it appeared on a postage stamp from the Cayman Islands in 1991, shown in Figure 9, three years before it was ready for launch.

3.5 Other Current Satellite Series

Geostationary weather satellites have also been launched by other countries. The first such satellite was the GMS (Geostationary Meteorological Satellite) launched by Japan in 1977. This spacecraft is pictured on two known postage stamps. The stamp in Figure 10 was issued by Japan in 1982.

The Europeans also launched their first geostationary meteorological satellite, Meteosat, in 1977. Meteosat satellites have been featured on several postage stamps, one of which is shown in Figure 11, on a stamp issued by Bulgaria in 1991.

India likewise has a series of geostationary satellites, the first one, Insat, was launched in 1982. No stamps are known to show any of this series of satellites. However, India also has a polar-orbiting satellite series designated IRS (Indian Remote Sensing) satellites (Europe, 1992). Figure 12

Figure 7. This stamp from Taiwan, issued in 1981 [Scott no.2221], is one of the few postage stamps featuring the current NOAA series of polar-orbiting meteorological satellites.

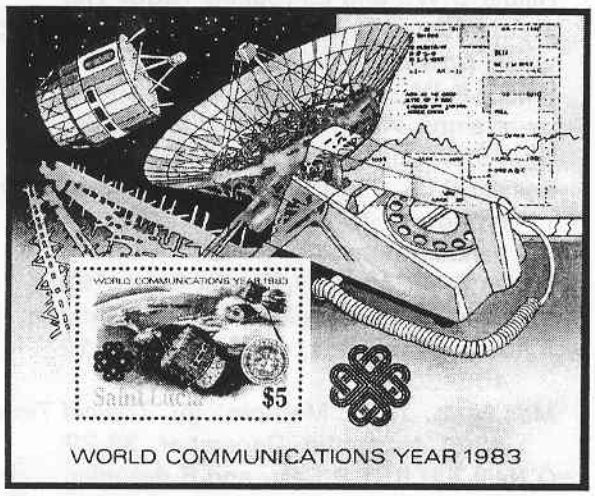

Figure 8. This souvenir sheet with one stamp, issued by St. Lucia in 1983 [Scott no.611], is the only known postage stamp to show any of the five satellites in the SMS / GOES series of geostationary meteorological satellites.

Figure 9. This stamp from the Cayman Islands is the first, and so far the only, postage stamp to show the GOES-Next (I through M) series of satellites. This stamp was issued in 1991 [Scott no.628], 3 years before the first in the series, GOES-8, was launched.

Figure 10. This stamp from Japan, issued in 1982 [Scott no.1564], is one of two known postage stamps showing the GMS series of geostationary meteorological satellites.

Figure 11. This stamp from Bulgaria, issued in 1991 [Scott no.3612], is one of the best representations of the Meteosat series of geostationary meteorological satellites, which has been featured on several postage stamps.

Figure 12. This stamp from India, issued in 1991 [Scott no.1352], is the only known postage stamp to feature the IRS series of remote sensing satellites.

Figure 13. This stamp from the United States, issued in 1991 [Scott no.2570], showing an early satellite in the Landsat series (similar looking to Nimbus experimental weather satellites), is the only postage stamp issued by the U.S. which features either an environmental or a weather satellite.

shows the IRS-1A satellite, launched in 1988, on a stamp issued by India in 1991, the only known stamp showing this series of satellites.

Finally, earth resources satellites are worthy of mention, in particular the Landsat series of satellites launched by the U.S. starting in 1972. Spacecraft design has changed over the years, but the series is still designated as Landsat. There have been five successful spacecraft, and one recent failure in 1993 which was supposed to have been Landsat-6. This series of satellites has appeared on several stamps from around the world, one of which is the postage stamp from the U.S. in Figure 13. This stamp was part of a series of ten stamps showing space satellites, one for each planet, with Landsat for the earth. Unfortunately this is the only stamp ever issued by the U.S. showing either a weather or an environmental satellite! A poor showing for a country that launched more satellites than any other country except the former Soviet Union.

4. SATELLITE LAUNCH COVERS

Another way to feature weather satellite history is through official postmarks. Almost every U.S. and many foreign satellite launches have been commemorated by a launch cover or envelope which has been postmarked on the day of the launch of the satellite. Many such launch covers are available among cover collectors, with the early satellite launches being the rarest and the hardest to obtain. A few examples of weather satellite launch covers will be shown at the conference.

5. SUMMARY AND CONCLUSIONS

Postage stamps can be used to tell the history of the development of most technologies. The history and evolution of weather satellites is well documented on postage stamps from around the world. These stamps can be used as an educational tool for sharing this history with students and others. Because of limited space, only a very cursory history of weather satellites has been presented. Many more aspects of the subject are possible using postage stamps along with other historical information. Look for future articles on weather topics and postage stamps by the author in the coming years.

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